



Preliminary Look At Period 11 High PT Lepton Data

Simona Rolli

Electrons ID




PerfIDia

http://ncdf70.fnal.gov:8001/PerfIDia/PerfIDia.html

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How to run the electron efficiency code on TopNtuple

The code runs in two steps:

- A standalone executable runs on TopNtuple:
 - 1.) `main_lepid`: basically reads in the command line arguments and then runs `ana_lepid`

Electrons ID: Samples



Dataset bhelmj: Runs 233133 to 237795

MC sample : zewkee (dataset zemtee as of June 20 2007)

GRL : preliminary GRL for Period 11

(<http://www-cdf.fnal.gov/internal/dqm/goodrun/good.html>)

Looked at 954 files (as of Friday, June 22) :

Electron ID: Cuts



CEM Selection Cuts

Variable	Tight (CEM)
Region	== CEM
Fiducial	Fiducial == 1
E_T	$\geq 20 \text{ GeV}$
Track Z_0	$\leq 60 \text{ cm}$
Track p_T	$\geq 10 \text{ GeV}/c$
COT Ax. Seg.	≥ 3
COT St. Seg.	≥ 2
Conversion	$\neq 1$
Had/em	$\leq (0.055 + (0.00045 \times E))$
Isolation	≤ 0.1
LshrTrk	≤ 0.2
E/P	≤ 2.0 unless $p_T \geq 50 \text{ GeV}/c$
CES ΔZ	$\leq 3.0 \text{ cm}$
Signed CES ΔX	$-3.0 \leq q \times \Delta X \leq 1.5$
CES StripChi2	≤ 10.0

Plug Selection Cuts

Variable	PHX	PEM
E_T	$\geq 20 \text{ GeV}$	$\geq 20 \text{ GeV}$
Pes2dEta	$1.2 \leq \eta \leq 2.8$	$1.2 \leq \eta \leq 2.8$
Had/Em	≤ 0.05	≤ 0.05
Pem3x3FitTow	$\neq 0$	$\neq 0$
Pem3x3Chisq	≤ 10	≤ 10
Pes5by9U	≥ 0.65	≥ 0.65
Pes5by9V	≥ 0.65	≥ 0.65
Isolation	≤ 0.1	≤ 0.1
ΔR	$\leq 3.0 \text{ cm}$	$\leq 3.0 \text{ cm}$
PhxMatch	TRUE	-
N_{hits}^{Si}	≥ 3	-
$ z_0^{PHX} $	$\leq 60 \text{ cm}$	-

Electron ID: Results

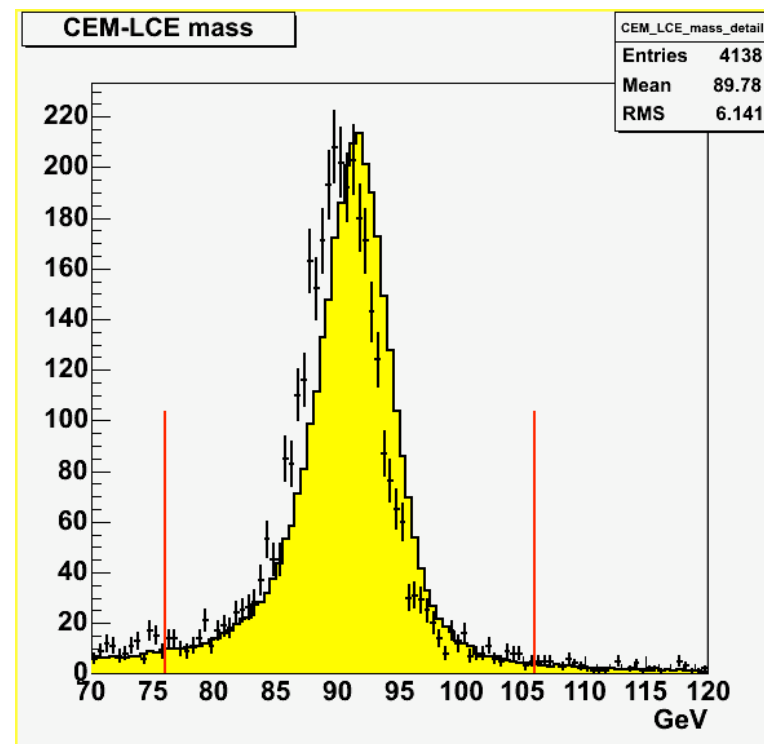
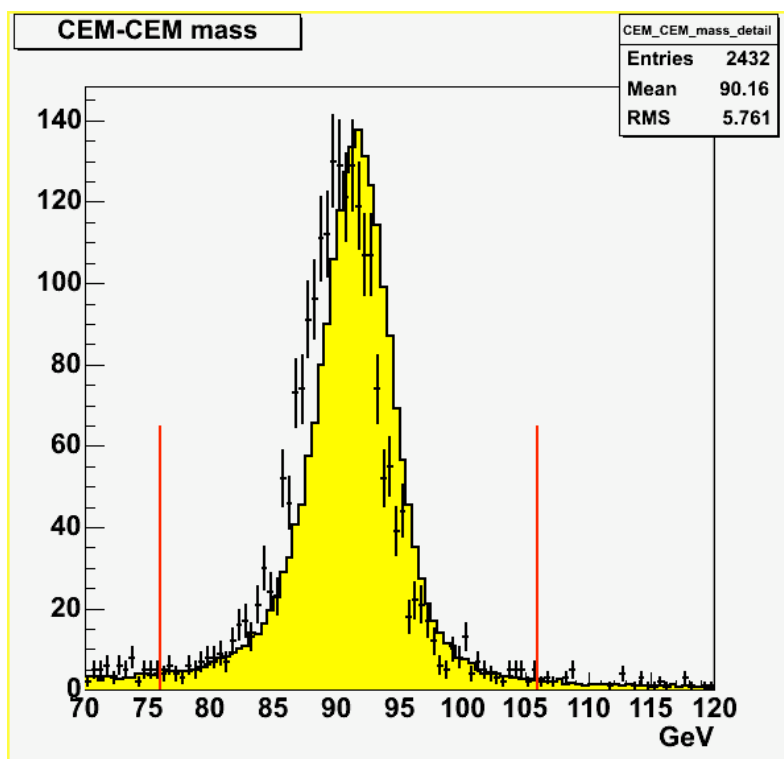


CEM		All errors are statistical only			
		0i Post SD	Per 9	bhelmi (Per 10)	MC (Zemted)
CEM Eff		0.788 +/- 0.005	0.789 +/- 0.005	0.787 +/- 0.004	0.805 +/- 0.001
CEM SF		0.977 +/- 0.006	0.978 +/- 0.006	0.978 +/- 0.005	N/A
nisoCEM Eff		0.816 +/- 0.004	0.818 +/- 0.005	0.816 +/- 0.004	0.830 +/- 0.001
nisoCEM SF		0.986 +/- 0.005	0.984 +/- 0.006	0.984 +/- 0.004	N/A
looseCEM Eff		0.915 +/- 0.003	0.914 +/- 0.003	0.914 +/- 0.003	0.917 +/- 0.001
looseCEM SF		0.996 +/- 0.004	0.996 +/- 0.004	0.996 +/- 0.003	N/A
nisolooseCEM Eff		0.945 +/- 0.003	0.945 +/- 0.003	0.946 +/- 0.002	0.947 +/- 0.001
nisolooseCEM SF		1.000 +/- 0.003	0.999 +/- 0.003	0.999 +/- 0.002	N/A
PHX					
Eff Eta < 2.0		0.708 +/- 0.007	0.700 +/- 0.008	0.702 +/- 0.006	0.758 +/- 0.001
SF Eta < 2.0		0.926 +/- 0.009	0.921 +/- 0.010	0.926 +/- 0.008	N/A
Eff Eta < 2.8		0.623 +/- 0.006	0.621 +/- 0.006	0.614 +/- 0.005	0.661 +/- 0.001
SF Eta < 2.8		0.929 +/- 0.009	0.936 +/- 0.010	0.929 +/- 0.008	N/A

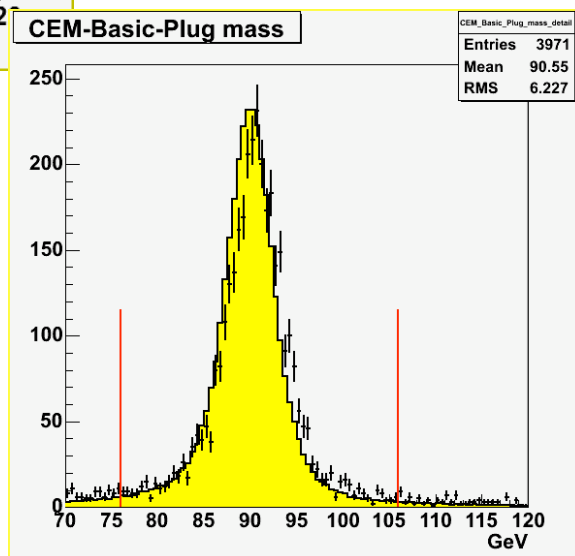
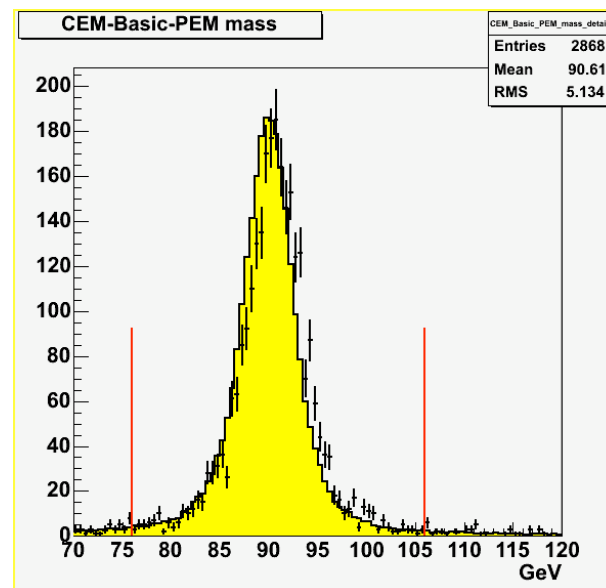
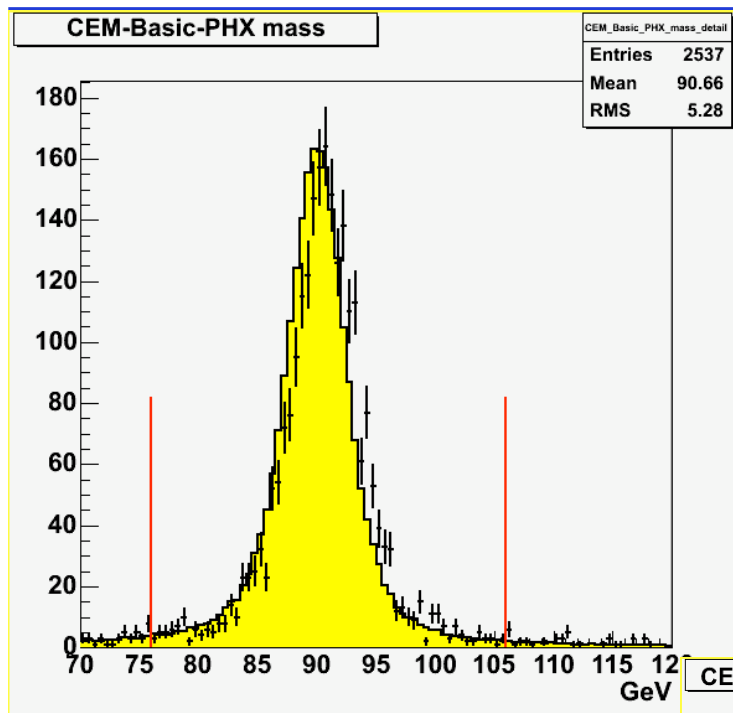
CEM	
Bhelmi(P11)	zewkee
0.7731+/-0.0055	0.7983 +/-0.0009
0.9684 +/-0.007	N/A
0.8089 +/-0.0052	0.8267 +/-0.0009
0.9784 +/-0.006	N/A
0.9064 +/- 0.0038	0.9090 +/-0.0009
0.9971 +/-0.004	N/A
0.94433+/-0.0009	0.9433 +/-0.0009
0.9966 +/-0.0034	N/A

PHX	
0.7109+/-0.008	0.7472+/-0.0012
0.9513+/- 0.0107	NA
In progress	In progress
In progress	N/A

Electron ID Z candidates



Electron ID Z candidates



Electron Trigger



PerfIDia

http://ncdf70.fnal.gov:8001/PerfIDia/PerfIDia.html

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How to run the electron trigger efficiency code on TopNtuple Preliminary

There are two steps in producing trigger efficiencies (tracking only for the moment):



- First step: a standalone (release dependent code runs on TopNt). Here are the instructions:


```
newrel -t 6.1.4 testrel;
cd testrel;
addpkg TopMods; setenv USESHLIBS yes ; gmake TopMods.nobin
addpkg JetUser jetCorr06b
gmake JetUser.lib LINK_SHARED_ROOT=yes
cvsroot zoom
addpkg ZMutility
addpkg Exceptions
gmake ZMutility.all USESHLIBS=1
gmake Exceptions.all USESHLIBS=1
in the test release add the following files (tar file with them here :
ana.cc
ana.hh
```

Electron Trigger: Tracking



1 electron with $E_T > 25 \text{ GeV}$
 $\cancel{E}_T > 25 \text{ GeV}$
 reject cosmic events

Table: Offline W selection.

Electron Variables	Current baseline cuts
E_T	$> 20 \text{ GeV}$
p_T	$> 10 \text{ GeV}/c$
N_{SL}^{axial} with 5 hits	≥ 3
N_{SL}^{stereo} with 5 hits	≥ 2
Fiducial	1
Had/Em	$< 0.055 + 0.00045E$
L_{shr}	< 0.2
E/p	< 2 (for $p_T < 50 \text{ GeV}$)
$ Z_{vertex} $	$< 60 \text{ cm}$
$ \Delta X $	$-3.0 < Q_{trk} \Delta X < 1.5 \text{ cm}$
$ \Delta Z $	$< 3 \text{ cm}$
χ_{strip}^2	< 10
Conversion	$\neq 1$ (not)

Table: Offline baseline cuts for central electrons.

L1 Tracking Efficiency

$$\epsilon(L1_XFT_PT8) = \frac{\text{numW \& passed L1_CEM8_PT8}}{\text{numW}}$$

numW means the number of W candidates that passed the W-NOTRACK path.

L2 Tracking Efficiency

At L2, there is no additional tracking done except for receiving the XFT information from L1.

$$\epsilon(L2_XFT_PT8) = \frac{\text{numW \& passed L1_CEM8_PT8 \& passed L2_CEM16_PT8}}{\text{numW \& passed L1_CEM8_PT8}}$$

L3 Tracking Efficiency

$$\epsilon(L3_PT9) = \frac{\text{numW \& passed L1_CEM8_PT8 \& L2_CEM16_PT8 \& L3_CEM18_PT9}}{\text{numW \& passed L1_CEM8_PT8 \& L2_CEM16_PT8}}$$

Electron Trigger: Calorimeter



L2 Calorimeter Efficiency

- Require at least 1 electron satisfying the baseline cuts and $E_T > 18\text{GeV}$.
- Use ELECTRON_CENTRAL_18_NO_L2 path.
- Efficiency reaches 100% at about 25 GeV.

$$\epsilon(\text{L2_CEM16}) = \frac{\text{numEl \& passed L1_CEM8_PT8 \& L2_PS \& L2_CEM16}}{\text{numEl \& passed L1_CEM8_PT8 \& L2_PS}}$$

L3 Calorimeter Efficiency

- Use the calibration dataset(blpc).
- Use ELECTRON_CENTRAL_8_NO_L2 path.
- Efficiency reaches 100% at about 20 GeV.

$$\epsilon(\text{L3_CEM18}) = \frac{\text{numEl \& passed EL_CENT_8_NO_L2 \& L2_CEM16 \& L3_CEM18}}{\text{numEl \& passed EL_CENT_8_NO_L2 \& L2_CEM16}}$$

Electron Trigger: Results

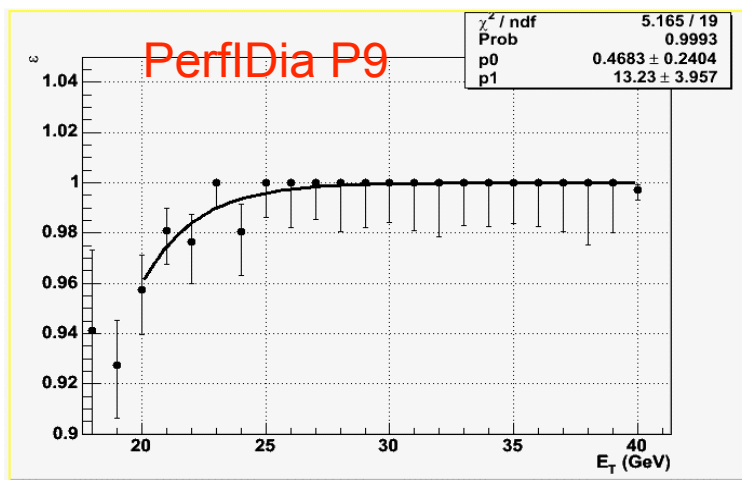


Trigger	Period 9	Period 10
L1_XFT_PT8	0.9651(6)	0.9677(5)
L2_XFT_PT8	0.9992(1)	0.9993(1)
L3 tracking	0.9954(2)	0.9924(2)
Total Tracking	0.9598(7)	0.9596(6)

Trigger	Period 9	Period 10A	Period 10B
L1_XFT_PT8	0.9651(6)	0.9673(7)	0.9650(29)
L2_XFT_PT8	0.9992(1)	0.9993(1)	0.9992(5)
L3 tracking	0.9954(2)	0.9932(3)	0.9968(9)
Total Tracking	0.9598(7)	0.9600(8)	0.9611(31)

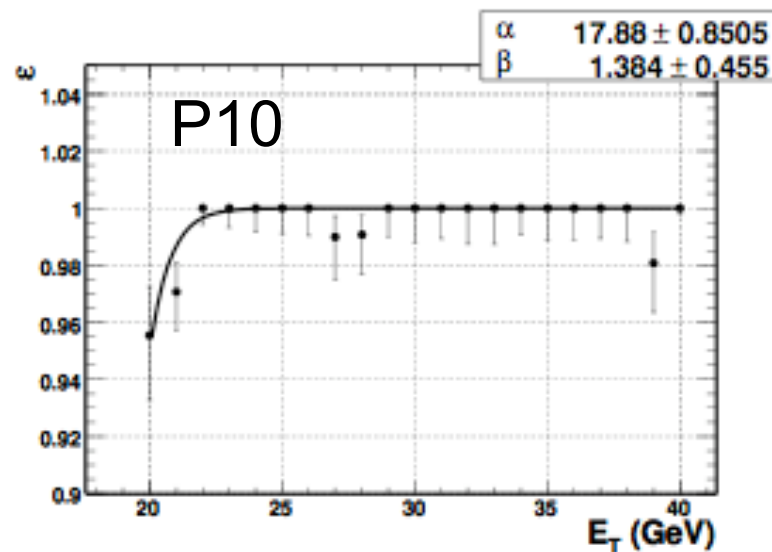
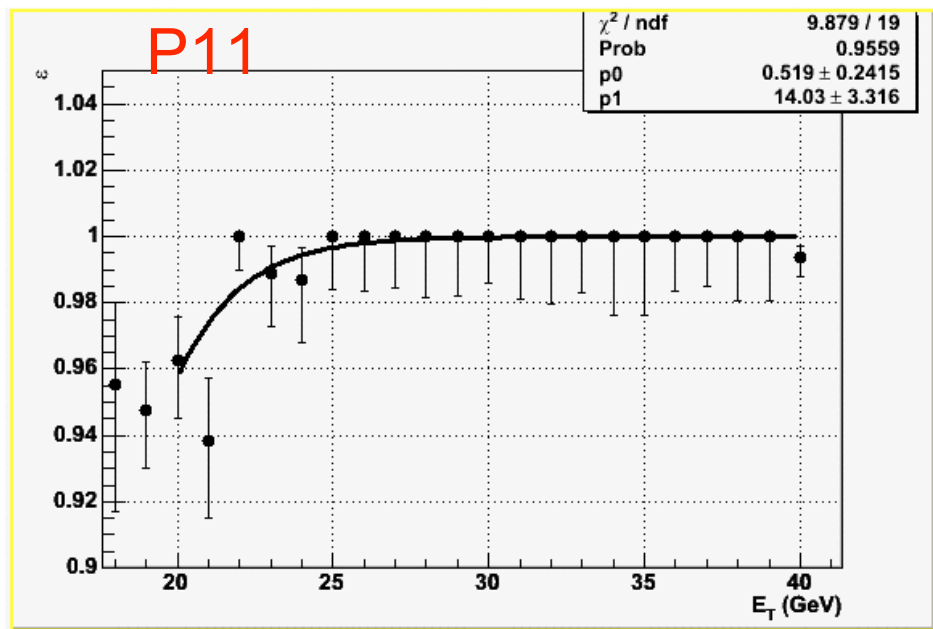
Period 11
0.9688(4)
0.9988(4)
0.9935(4)
0.9614(4)

Electron Trigger : Results



L2_CEM16 calorimeter efficiency

$$\epsilon = \frac{1}{1 + e^{-\beta(E_T - \alpha)}}$$



Everything looks fine

Muons



Dataset bhelmi: Runs 233133 to 237795

MC sample : zewkem

GRL : Preliminary P11 GRL

~100 files out of 729

ID and Reco preliminary results

Trigger Efficiencies not evaluated at this time

Muon ID Efficiency: ID Cuts



For all events:

No cosmic tag.

For all muon types (including stubless muons):

P_T	$>$	20 GeV/c
E_{EM}	$<$	$2 + \max(0, (p - 100) \cdot 0.0115)$ GeV
E_{HAD}	$<$	$6 + \max(0, (p - 100) \cdot 0.028)$ GeV
$E_T^{isol.} / P_T$	$<$	0.1
Number of axial SL with ≥ 5 hits	\geq	3
Number of stereo SL with ≥ 5 hits	\geq	2
	$ z_0 $	$<$ 60 cm
Tracks w/ no silicon hits:	$ d_0 $	$<$ 0.2 cm
Tracks w/ silicon hits:	$ d_0 $	$<$ 0.02 cm

Additionally for tight CMUP muons:

	$ \Delta x_{CMU} $	$<$ 7 cm
	$ \Delta x_{CMP} $	$<$ 5 cm
No bluebeam muons, run		$<$ 154449

Additionally for tight CMX muons:

	$ \Delta x_{CMX} $	$<$ 6 cm
	Run	$>$ 150144
No miniskirt or keystone muons, run		$<$ 190697
No muons in wedge 14 west, runs		\geq 190697 and \leq 209760

Table 1: Standard muon ID cuts for 6.1.4 data MC.

Fiducial cuts



For CMUP muons:

Fiducial distance from CMU:	
x -fid	< 0 cm
z -fid	< 0 cm
Fiducial distance from CMP:	
x -fid	< 0 cm
z -fid	< -3 cm
No muons from bluebeam region for run < 154449	

For CMX muons:

ρ_{COT}	> 140 cm
Fiducial distance from CMX:	
x -fid	< 0 cm
z -fid	< -3 cm
No muons from keystone region for run < 190697	
No muons from miniskirt region for run < 190697	
No muons wedge 14 west for runs ≥ 190697 and ≤ 209760	

Table 2: Suggested muon fiducial cuts for tight muons in release 6.1.4.

Arches:	
$0^\circ \leq \phi \leq 75^\circ$ or $105^\circ \leq \phi \leq 225^\circ$ or $315^\circ \leq \phi < 360^\circ$	
Additionally, for runs 190697 - 209760, remove:	
$210^\circ < \phi \leq 225^\circ$ if $\eta < 0$	
Keystone:	
$75^\circ < \phi < 105^\circ$ and $\eta < 0$	
Miniskirt:	
$225^\circ < \phi < 315^\circ$	

Table 3: Cuts on ϕ for distinguishing parts of the CMX detector when determining reconstruction efficiencies.

ID Efficiency Calculation



- A first leg must be a CMUP or CMX muon passing all the cuts given in Tables 1 and 2.
- A second leg must be a muon with a CMUP or CMX stub and satisfy:
 - $P_T > 20$ GeV.
 - fiducial requirements in Table 2.
- The event must not have a cosmic tag.
- The z_0 of the two legs must pass: $|z_0^{(1)} - z_0^{(2)}| < 4$ cm.
- The invariant mass of the two tracks must pass: $81 < m(\mu^+\mu^-) \text{ GeV}/c^2 < 101$.

We then test the second leg to determine if it passes each of the muon ID cuts given in Table 1.

CMUP ID Efficiency



We are using $Z \rightarrow \mu^+ \mu^-$ events with one identified leg (CMUP or CMX).
This first leg must pass all the ID cuts and must match to level 1 trigger information.
We are then looking if the second leg passes ID cuts in question.

	Efficiency (%)						bhmumj	zewkern
	bhmu0i2 p8	bhmumi p9	zewkmm	bhmumi p10	zemtdm	Count	Efficiency (%)	Efficiency (%)
E_{EM} cut	96.35 ± 0.36	$97.36^{+0.32}_{-0.36}$	$96.22^{+0.08}_{-0.08}$	$97.68^{+0.23}_{-0.26}$	$96.20^{+0.06}_{-0.06}$	502		
E_{HAD} cut	97.91 ± 0.27	$98.32^{+0.25}_{-0.29}$	$98.31^{+0.05}_{-0.06}$	$98.45^{+0.19}_{-0.22}$	$98.30^{+0.04}_{-0.04}$	487	$97.01^{+0.79}_{-0.97}$	$96.23^{+0.06}_{-0.07}$
COT hits cut	99.96 ± 0.04	$99.93^{+0.04}_{-0.10}$	$99.99^{+0.00}_{-0.01}$	$99.95^{+0.04}_{-0.07}$	$100.0^{+0.00}_{-0.00}$	493	$98.21^{+0.57}_{-0.80}$	$98.33^{+0.04}_{-0.04}$
d_0 cut	99.71 ± 0.10	$99.50^{+0.12}_{-0.17}$	$99.87^{+0.02}_{-0.02}$	$99.56^{+0.10}_{-0.13}$	$99.72^{+0.00}_{-0.02}$	502	$100.00^{+0.00}_{-0.37}$	$99.99^{+0.00}_{-0.00}$
Isolation cut	96.79 ± 0.34	$96.90^{+0.35}_{-0.39}$	$97.24^{+0.07}_{-0.06}$	$96.86^{+0.29}_{-0.30}$	$97.31^{+0.05}_{-0.05}$	494	$98.41^{+0.57}_{-0.80}$	$99.84^{+0.01}_{-0.01}$
Δx_{CMU} cut	99.60 ± 0.12	$99.75^{+0.10}_{-0.13}$	$99.99^{+0.00}_{-0.01}$	$99.51^{+0.12}_{-0.14}$	$99.99^{+0.00}_{-0.00}$	482	$96.02^{+0.91}_{-1.05}$	$96.80^{+0.06}_{-0.06}$
Δx_{CMP} cut	98.52 ± 0.23	$98.04^{+0.28}_{-0.31}$	$99.43^{+0.03}_{-0.03}$	$98.45^{+0.19}_{-0.22}$	$99.42^{+0.00}_{-0.03}$	496	$98.80^{+0.49}_{-0.68}$	$99.99^{+0.00}_{-0.01}$
All above cuts	89.53 ± 0.58	$90.44^{+0.53}_{-0.54}$	$91.49^{+0.12}_{-0.11}$	$91.08^{+0.44}_{-0.48}$	$91.41^{+0.09}_{-0.10}$	497	$99.00^{+0.43}_{-0.69}$	$99.44^{+0.02}_{-0.03}$
All cuts excl. isol.	92.34 ± 0.51	$93.08^{+0.50}_{-0.52}$	$93.94^{+0.10}_{-0.10}$	$93.89^{+0.37}_{-0.41}$	$93.76^{+0.08}_{-0.08}$	445	$88.65^{+1.49}_{-1.63}$	$91.07^{+0.10}_{-0.10}$
Sliding isol. cut	97.40 ± 0.30	$97.97^{+0.25}_{-0.29}$	$97.66^{+0.06}_{-0.06}$	$97.71^{+0.23}_{-0.26}$	$97.77^{+0.05}_{-0.05}$	463	$92.23^{+1.23}_{-1.31}$	$93.93^{+0.08}_{-0.08}$
All cuts (sliding isol.)	90.07 ± 0.57	$91.43^{+0.53}_{-0.54}$	$91.87^{+0.12}_{-0.12}$	$91.86^{+0.45}_{-0.48}$	$91.82^{+0.08}_{-0.09}$	489	$97.41^{+0.69}_{-0.88}$	$97.59^{+0.05}_{-0.05}$
						452	$90.04^{+1.27}_{-1.47}$	$91.79^{+0.10}_{-0.10}$

CMX ID Efficiency



	Efficiency (%)					bhmumj		zewkem
	bhmu0i2 p8	bhmumi p9	zewkmm	bhmumi p10	zemt dm	Count	Efficiency (%)	Efficiency (%)
E _{EM} cut	96.59 ± 0.44	97.34 ^{+0.39} _{-0.44}	96.32 ^{+0.10} _{-0.10}	97.24 ^{+0.34} _{-0.39}	96.40 ^{+0.07} _{-0.08}	270		
E _{HAD} cut	98.14 ± 0.33	97.88 ^{+0.34} _{-0.40}	97.88 ^{+0.08} _{-0.08}	98.03 ^{+0.29} _{-0.30}	97.90 ^{+0.06} _{-0.06}	261	96.67 ^{+1.09} _{-1.45}	96.35 ^{+0.08} _{-0.09}
COT hits cut	100.0 ± 0.00	100.0 ^{+0.00} _{-0.11}	100.0 ^{+0.00} _{-0.01}	99.92 ^{+0.05} _{-0.10}	99.99 ^{+0.00} _{-0.01}	270	100.00 ^{+0.00} _{-0.68}	99.98 ^{+0.01} _{-0.01}
d ₀ cut	99.64 ± 0.15	99.76 ^{+0.11} _{-0.19}	99.88 ^{+0.02} _{-0.02}	96.85 ^{+0.35} _{-0.39}	99.78 ^{+0.02} _{-0.02}	269	99.63 ^{+0.30} _{-0.83}	99.88 ^{+0.01} _{-0.02}
Isolation cut	97.85 ± 0.36	97.03 ^{+0.40} _{-0.48}	97.43 ^{+0.08} _{-0.09}	96.85 ^{+0.35} _{-0.39}	97.40 ^{+0.07} _{-0.07}	263	97.41 ^{+0.98} _{-1.36}	97.08 ^{+0.07} _{-0.08}
Δx _{CMX} cut	99.64 ± 0.15	99.39 ^{+0.18} _{-0.26}	99.83 ^{+0.02} _{-0.03}	99.88 ^{+0.06} _{-0.12}	99.86 ^{+0.01} _{-0.02}	270	100.00 ^{+0.00} _{-0.68}	99.85 ^{+0.02} _{-0.02}
All above cuts	92.22 ± 0.66	92.31 ^{+0.71} _{-0.76}	91.72 ^{+0.14} _{-0.15}	92.11 ^{+0.51} _{-0.56}	91.76 ^{+0.11} _{-0.11}	244	90.37 ^{+1.72} _{-2.19}	91.40 ^{+0.12} _{-0.12}
All cuts excl. isol.	94.08 ± 0.58	94.85 ^{+0.51} _{-0.57}	93.99 ^{+0.13} _{-0.13}	94.83 ^{+0.45} _{-0.47}	94.04 ^{+0.10} _{-0.10}	251	92.96 ^{+1.47} _{-1.85}	94.00 ^{+0.11} _{-0.10}
Sliding isol. cut	98.38 ± 0.31	97.40 ^{+0.38} _{-0.45}	97.81 ^{+0.08} _{-0.08}	97.83 ^{+0.29} _{-0.35}	97.91 ^{+0.06} _{-0.06}	266	98.52 ^{+0.75} _{-1.20}	97.79 ^{+0.06} _{-0.07}
All cuts (sliding isol.)	92.70 ± 0.64	92.62 ^{+0.70} _{-0.67}	92.06 ^{+0.14} _{-0.15}	92.98 ^{+0.50} _{-0.53}	92.21 ^{+0.11} _{-0.12}	247	91.48 ^{+1.78} _{-2.13}	92.04 ^{+0.11} _{-0.12}

Reconstruction Efficiency



The reconstruction efficiency is defined as the probability to find a muon stub and link it to a track. First, to know whether we should find a stub or not we have to know that the muon is fiducial in any of the muon chambers. We use the `MuonFiducialTool` class for this purpose. We define a track as being fiducial in a given muon system if it passes the cuts defined in Tables 2 and 3 for that system.

Events Selection

No cosmic tag and 2 tracks passing the following:

- Oppositely charged.
- $|z_0^{(1)} - z_0^{(2)}| < 4$ cm.
- $81 \text{ GeV}/c^2 < m(\mu^+\mu^-) < 101 \text{ GeV}/c^2$
- The first leg must be a reconstructed `CdfMuon` passing all the ID and fiducial cuts given in Tables 1 and 2. It must also match to the level 1 trigger information.
- The second leg must be fiducial in both the CMU and CMP sub-detectors (or the CMX sub-detector) and satisfy:
 - $P_T > 20 \text{ GeV}$.
 - $E_{EM} < 1.5 \cdot (2 + \max(0, (p - 100) \cdot 0.0115)) \text{ GeV}$
 - $E_{HAD} < 1.5 \cdot (6 + \max(0, (p - 100) \cdot 0.028)) \text{ GeV}$

$$\epsilon_{\text{Reco}} = \frac{\text{\#tracks fiducial and linked to a stub}}{\text{\# tracks fiducial}}$$

Reconstruction Efficiency



The first leg must pass all the ID and Fid. cuts and must match to the level 1 trigger information. If the second leg is Fiducial, and pass “ P_T , E_{EM} , E_{HAD} ” cuts, we examine this track to see if is linked to a muon stub or not.

Efficiency (%)						bhmumj	
DATA	bhmu0h	bhmu0i	bhmu0i2 p8	bhmumi p9	bhmumi p10	Efficiency (%)	
CMUP	91.63 ± 0.34	91.78 ± 0.42	93.04 ± 0.47	92.70 ^{+0.49} _{-0.53}	91.22 ^{+0.46} _{-0.47}	90.88 ^{+1.21} _{-1.32}	
CMX	97.47 ± 0.25	97.39 ± 0.31	96.67 ± 0.44	95.09 ^{+0.57} _{-0.60}	95.99 ^{+0.37} _{-0.41}	94.49 ^{+1.32} _{-1.81}	
Arches	99.07 ± 0.18	98.68 ± 0.25	98.91 ± 0.29	98.05 ^{+0.37} _{-0.46}	98.47 ^{+0.29} _{-0.37}	99.06 ^{+0.60} _{-1.25}	
Miniskirt	92.57 ± 0.94	92.62 ± 1.18	87.96 ± 1.81	82.09 ^{+2.18} _{-2.50}	85.59 ^{+1.62} _{-1.90}	76.47 ^{+5.95} _{-7.33}	
Keystone	91.67 ± 2.13	94.50 ± 2.18	95.77 ± 2.39	93.65 ^{+3.03} _{-4.78}	92.63 ^{+2.49} _{-3.16}	88.89 ^{+8.77} _{-21.31}	

Efficiency (%)					zewkem	
MC	zewk9m	zewkbm	zewkmm	zemtdm	Efficiency (%)	
CMUP	97.57 ± 0.03	97.43 ± 0.06	97.42 ^{+0.06} _{-0.06}	97.58 ^{+0.05} _{-0.05}	97.60 ^{+0.05} _{-0.05}	
CMX	99.61 ± 0.02	99.62 ± 0.03	99.65 ^{+0.03} _{-0.04}	99.64 ^{+0.02} _{-0.03}	99.61 ^{+0.03} _{-0.03}	
Arches	99.79 ± 0.02	99.80 ± 0.03	99.80 ^{+0.03} _{-0.03}	99.80 ^{+0.02} _{-0.02}	99.79 ^{+0.02} _{-0.03}	
Miniskirt	99.06 ± 0.06	99.07 ± 0.12	99.26 ^{+0.10} _{-0.12}	99.17 ^{+0.09} _{-0.09}	99.05 ^{+0.10} _{-0.11}	
Keystone	98.99 ± 0.13	98.90 ± 0.26	98.70 ^{+0.30} _{-0.33}	98.90 ^{+0.21} _{-0.23}	98.96 ^{+0.20} _{-0.24}	

Reco and ID SF



ID Scale Factor					bhmumj P11	
Category	bhmu0i	bhmu0i2 p8	bhmumi p9	bhmumi p10		
CMUP all cuts.	0.9753 ± 0.0052	0.9752 ± 0.0064	0.9885 ^{+0.0059} _{-0.0061}	0.9964 ^{+0.0049} _{-0.0054}	0.9734 ^{+0.0164} _{-0.0180}	
Excl. Isol.	0.9854 ± 0.0044	0.9821 ± 0.0055	0.9908 ^{+0.0054} _{-0.0030}	1.0014 ^{+0.0040} _{-0.0041}	0.9819 ^{+0.0131} _{-0.0140}	
Sliding Isol. cut	0.9804 ± 0.0050	0.9952 ± 0.0031	1.0031 ^{+0.0027} _{-0.0030}	0.9993 ^{+0.0024} _{-0.0027}	0.9982 ^{+0.0070} _{-0.0090}	
CMX all cuts	1.0012 ± 0.0057	1.0001 ± 0.0073	1.0065 ^{+0.0078} _{-0.0085}	1.0038 ^{+0.0057} _{-0.0062}	0.9887 ^{+0.0189} _{-0.0240}	
Excl. Isol.	1.0010 ± 0.0049	0.9989 ± 0.0063	1.0092 ^{+0.0056} _{-0.0062}	1.0085 ^{+0.0049} _{-0.0051}	0.9889 ^{+0.0157} _{-0.0197}	
Sliding Isol. cut	1.0020 ± 0.0056	1.0034 ± 0.0032	0.9957 ^{+0.0040} _{-0.0047}	0.9992 ^{+0.0030} _{-0.0036}	1.0074 ^{+0.0077} _{-0.0123}	
RECO Scale Factor					bhmumj P11	
	bhmu0i	bhmu0i2 p8	bhmumi p9	bhmumi p10		
CMUP	0.9406 ± 0.0043	0.9550 ± 0.0049	0.9515 ^{+0.0051} _{-0.0055}	0.9348 ^{+0.0047} _{-0.0048}	0.9311 ^{+0.0125} _{-0.0136}	
CMX	0.9777 ± 0.0031	0.9703 ± 0.0044	0.9542 ^{+0.0057} _{-0.0061}	0.9634 ^{+0.0037} _{-0.0041}	0.9485 ^{+0.0132} _{-0.0182}	
Arches	0.9889 ± 0.0025	0.9911 ± 0.0029	0.9824 ^{+0.0037} _{-0.0046}	0.9867 ^{+0.0029} _{-0.0030}	0.9926 ^{+0.0060} _{-0.0124}	
Mini./Key.	0.9386 ± 0.0106	0.9024 ± 0.0157	0.8484 ^{+0.0193} _{-0.0193}	0.8758 ^{+0.0158} _{-0.0158}	0.7910 ^{+0.0571} _{-0.0571}	

Conclusions



- Final results on July 11th
 - ◆ All data
 - ◆ MC done
- Plan to bless by July 25th
 - ◆ In time for LP